

STEPTOE & JOHNSON LLP

ATTORNEYS AT LAW

1330 CONNECTICUT AVENUE, N.W.
WASHINGTON, D.C. 20036-1795

PHOENIX, ARIZONA
TWO RENAISSANCE SQUARE

TELEPHONE: (602) 257-5200
FACSIMILE: (602) 257-5299

(202) 429-3000
FACSIMILE: (202) 429-3902
TELEX: 89-2503

STEPTOE & JOHNSON INTERNATIONAL
AFFILIATE IN MOSCOW, RUSSIA

TELEPHONE: (011-7-501) 258-5250
FACSIMILE: (011-7-501) 258-5251

PANTELIS MICHALOPOULOS*
(202) 429-6494
*Admitted in NY only.

EX PARTE OR LATE FILED

October 10, 1996

RECEIVED
OCT 17 1996
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, DC 20554

Re: Ex parte presentation in RM-8811, ET Docket
No. 95-183, RM-8553, PP Docket No. 93-253,
ET Docket No. 94-124/ RM-8308

Dear Mr. Caton:

Pursuant to Section 1.1206 of the Commission's rules and regulations, Motorola Satellite Communications, Inc. ("Motorola") hereby reports that an ex parte presentation was made on October 8, 1996 by representatives of Motorola to the following:

Karl Kensinger	International Bureau
John Williams	Office of Plans and Policy
Ronald Netro	Wireless Telecommunications Bureau
Steve Sharkey	Office of Engineering and Technology
Michael Marcus	Office of Engineering and Technology
Joe Heaps	International Bureau
Harry Ng	International Bureau

In that presentation, the Motorola representatives presented and discussed the attached document. They also discussed Motorola's position in the above-captioned proceedings, as that position has been set forth in Motorola's pleadings in these proceedings. Specifically, the Motorola representatives analyzed the spectrum needs of satellite systems in the frequencies implicated in these proceedings.

No. of Copies rec'd 021
List ABCDE

Mr. William F. Caton
October 10, 1996
Page 2

Three originals and three copies of this letter are being submitted for inclusion in the above-referenced dockets.

Sincerely,



Pantelis Michalopoulos
Attorney for Motorola Satellite
Communications, Inc.

Attachment

cc: Mr. Karl Kensinger
Mr. John Williams
Mr. Ronald Netro
Mr. Steve Sharkey
Mr. Michael Marcus
Mr. Joe Heaps
Mr. Harry Ng



MOTOROLA

Satellite Communications Division

The M-Star System

**A Global Network of Non-Geostationary Communications
Satellites Providing Broadband Services
in the 40 GHz Band**

**Filed 4 September 1996 by:
Motorola Satellite Systems, Inc.**



MOTOROLA

Satellite Communications Division

Agenda

- **System Description**
- **Business Plan**
- **Spectrum Requirements**
- **Sharing Analysis - Fixed Systems**
- **Sharing With Other Systems**
- **Sharing Rules**
- **Summary**



MOTOROLA

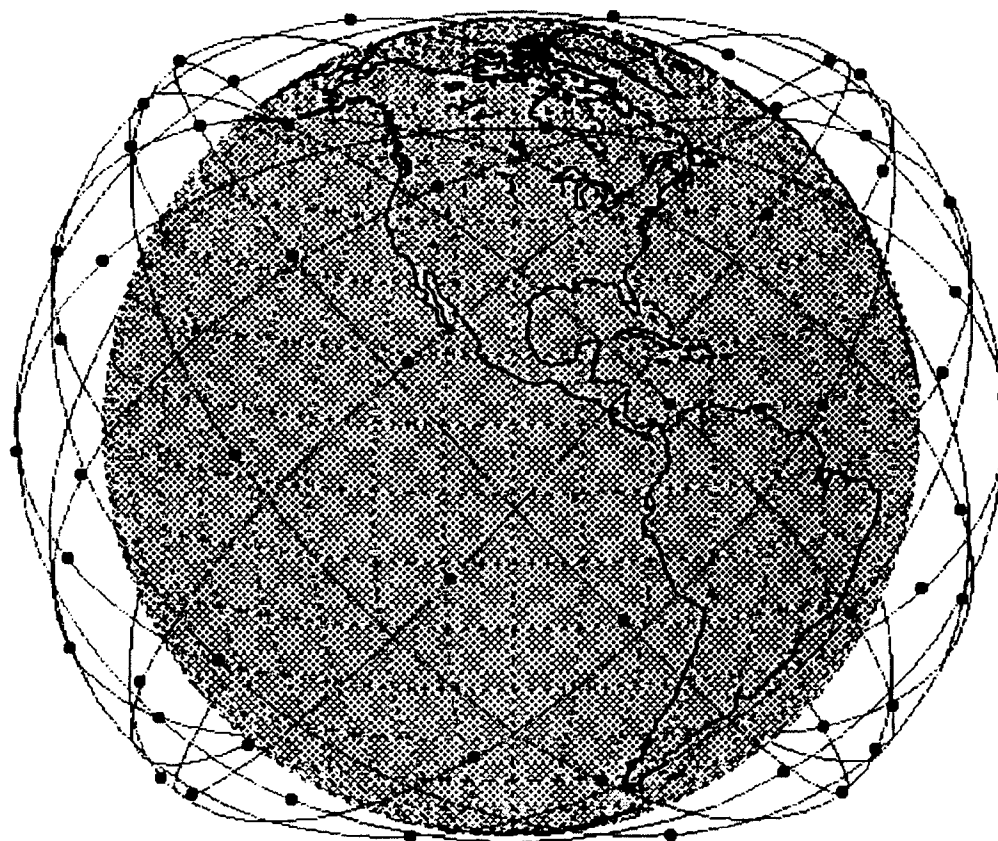
Satellite Communications Division

M-Star System Description

- **Non-GSO Global satellite system comprising 72 satellites.**
- **Real-time wide-band information transfer**
 - ⇒ **Voice, Data, Digital Video, and Audio.**
 - ⇒ **Covering protocols such as ISDN, Frame Relay, X.25, TCP/IP, ATM, FDDI, and OC-1.**
- **Data rates from 2.048 Mbps to 51.84 Mbps.**

**MOTOROLA***Satellite Communications Division*

M-Star



Number of Planes:	12
Satellites per Plane:	6
Inclination:	47°
Altitude:	1350 km
Argument of Perigee:	0°
Eccentricity:	0.0013
Plane Spacing at Equator:	30°
Plane Phasing:	+25°
Minimum elevation Angle:	22°
Orbit Period:	6761 seconds

**MOTOROLA***Satellite Communications Division*

M-Star Communications

Parameter Description	WAG/ E-1 Specification	HBR Specification
Modulation Format	QPSK	QPSK
Coding	Convolutional Concatenated With Reed Solomon	Convolutional Concatenated With Reed Solomon
Target Bit Error Rate	10^{-6}	10^{-9}
Data Rates (information)	2.048 Mbps	51.84 Mbps
Downlink Bandwidth	3 GHz	3 GHz
Uplink Bandwidth	3 GHz	3 GHz
E_b/N_0 requirement	2.2 dB	2.7 dB
Ground Station RF Power Amplifier	up to 7.9 W for E-1 Terminals	up to 46.2 W for MTSO Terminals to Cell Site up to 79.5 W for HBR Terminals
Ground Terminal Aperture (m)	0.66	1.5
Ground Terminal Figure of Merit G/T	19.3 dB/ K	26.4 dB/ K



MOTOROLA

Satellite Communications Division

Business Plan

M-Star will provide

- **Competitively priced regional and global communication**
- **Ready to use broadband infrastructure by 2000**
 - ⇒ **Lower total cost than global fiber networks**
 - ⇒ **Less time to build than a global fiber network**
- **Enhanced competition in telecommunication markets**

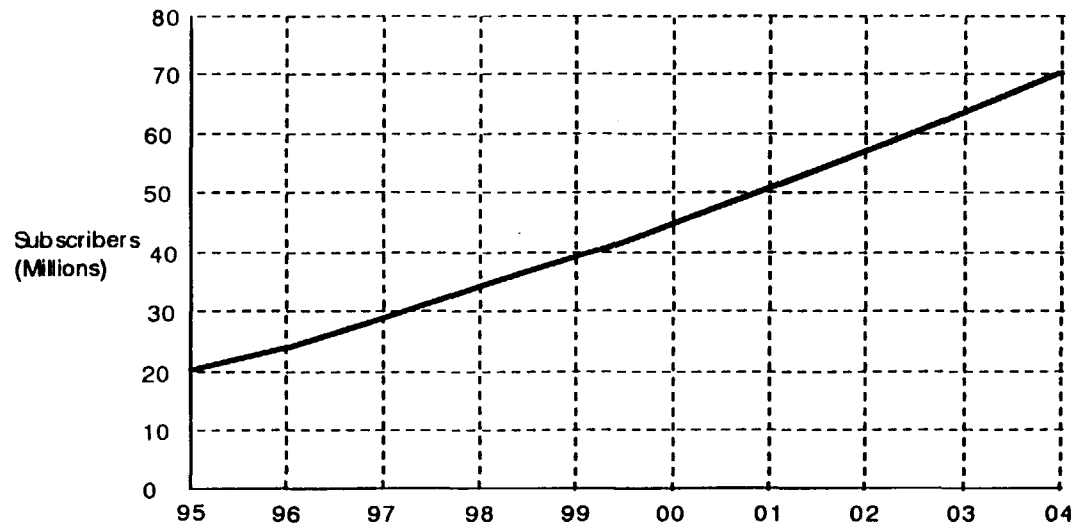


MOTOROLA

Satellite Communications Division

Market & Demand for Services

- **Third generation wireless services will include several advanced forms of voice and data communications transmitted from pocket sized telephones, wireless facsimile machines and other portable devices**



The growth of wireless subscribers forecasted by the Yankee Group (Reference: "PCS: The Implementation Phase", the Yankee Group, February 1995).



MOTOROLA

Satellite Communications Division

Market & Demand for Services

- **M-Star provides for the interconnection between backhauls**
- **M-Star provides for LAN - LAN direct connections**
- **M-Star provides for small services connectivity or an aggregate of service providers (E-1)**



MOTOROLA

Satellite Communications Division

M-Star Spectrum Plan

- **Service Links:**
 - 37.5 - 40.5 GHz (Space-to-Earth)
 - 47.2 - 50.2 GHz (Earth-to-Space)
- **Inter-Satellite Links:**
 - 59.0 - 64.0 GHz
- **TT&C Links will operate in the service link band**
 - ⇒ Launch and emergency operations in FSS band below 18 GHz



MOTOROLA

Satellite Communications Division

M-Star Satellite Capacity

- **Traffic Capacity**

- ⇒ **The distribution of end users will create high peak demands on the system. These peak demands are a key determinant of the overall spectrum requirements.**
- ⇒ **High peak traffic demands are managed by the use of a LEO Constellation, a versatile satellite payload and an antenna designed to create relative small beam coverage areas in the satellite coverage footprint.**
- ⇒ **A single space vehicle will support as many as 1800 E-1 links and 16 OC-1 links.**



MOTOROLA

Satellite Communications Division

M-Star Typical Spectrum Requirements

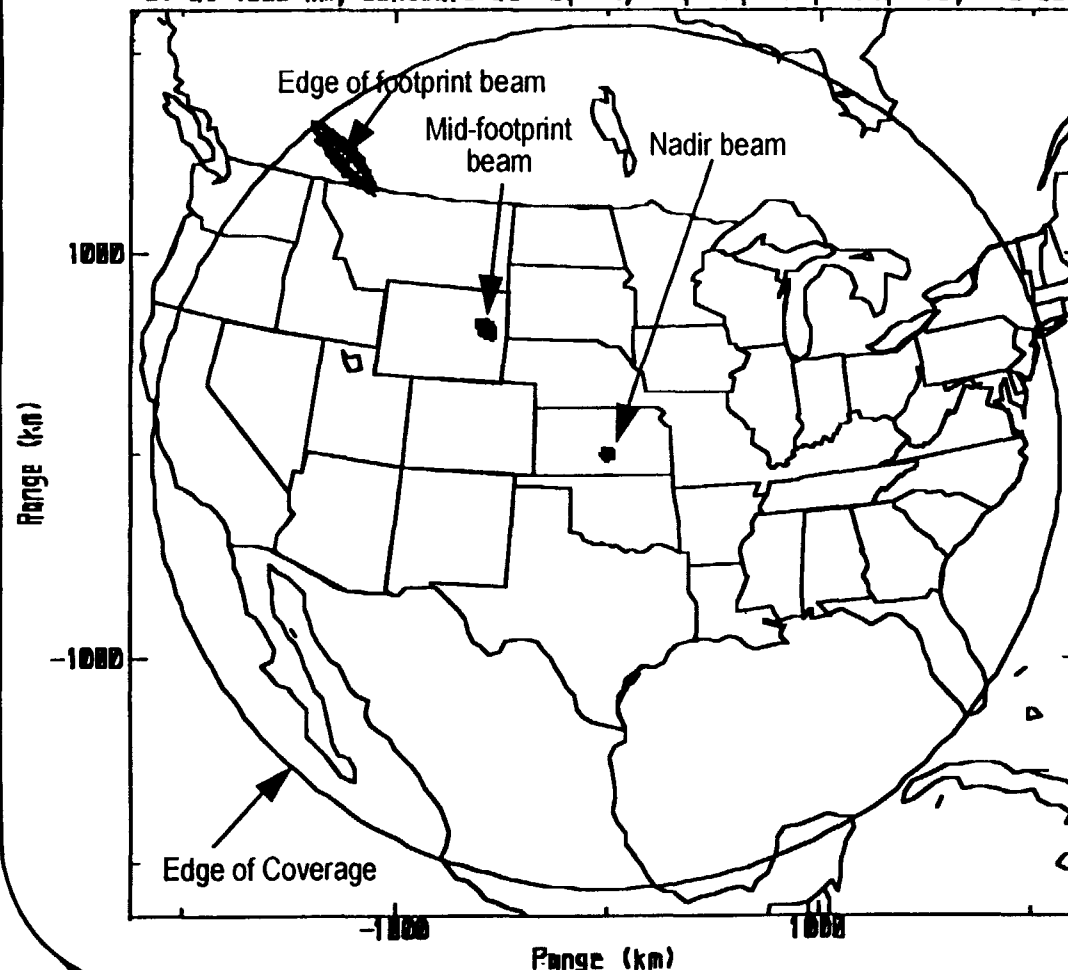
- **Town & Small City**
 - ⇒ **250 E-1 links/town**
 - ⇒ **25 E-1 links/transponder**
 - ⇒ **1 OC-1 link/town**
 - ⇒ **90 MHz/transponder**
 - ⇒ **990 MHz per town**
- **Large City**
 - ⇒ **450 E-1 links/city**
 - ⇒ **25 E-1 links/transponder**
 - ⇒ **15 OC-1 links/city**
 - ⇒ **90 MHz/transponder**
 - ⇒ **2970 MHz/city**

**MOTOROLA**

Satellite Communications Division

**M-Star Satellite
Footprint**

SV at 1350 km; Contours at -2, -4, -6, -8, -10, -14, -18, -22 dB

QPSK Modulation, Convolutional Coding
concatenated with R/S

E1 Links

BER 10⁻⁶
Eb/No 2.2 dB
Rate 2.048 Mbps
BW 3 GHz
Xmit Antenna 0.66 m 7.9 W
Rx Antenna G/T=19.3 dB/K

OC-1 Links

BER 10⁻⁹
Eb/No 2.7 dB
Rate 51.84 Mbps
BW 3 GHz
Xmit Antenna 1.5 m 46.2 to 79.5 W
Rx Antenna G/T=26.4 dB/K



MOTOROLA

Satellite Communications Division

Sharing with Fixed Service

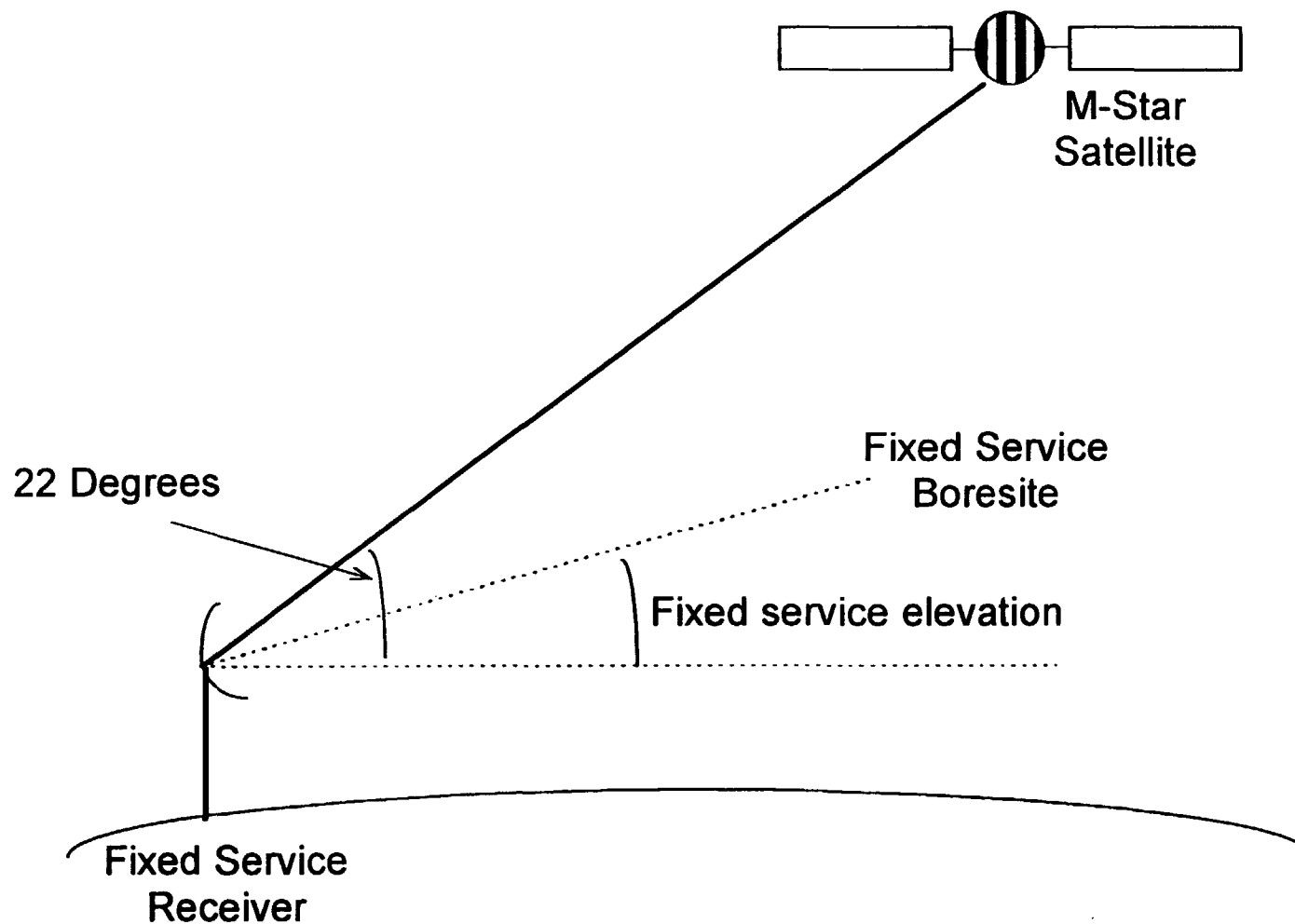
- **M-Star into Fixed Service**
 - ⇒ 37.5 - 40.5 GHz band (Sharing with Satellites).
 - ⇒ 47.2 - 50.2 GHz band (Sharing with Earth Stations).
- **Fixed Service interference into M-Star**
 - ⇒ 37.5 - 40.5 GHz band (Sharing with Earth Stations).
 - ⇒ 47.2 - 50.2 GHz band (Sharing with Satellites).



MOTOROLA

Satellite Communications Division

**Geometry of M-Star Downlink
Into Fixed Service at 40 GHz**





MOTOROLA

Satellite Communications Division

M-Star Satellites into FS (37.5 - 40.5 GHz)

- **M-Star is below 47 CFR 25.208(c) PFD limits**
- **Downlink calculations show that the peak Io/
No interference level experienced by the
Fixed Service is -14.2 dB.**
- **M-Star downlink can share without
coordination.**

**MOTOROLA****Satellite Communications Division****Analysis Details of M-Star
Downlink into Fixed Service
at 40 GHz****PEAK IMPACT OF M-STAR DOWNLINK**

	Cell Site	OC-1 (MTSO)	OC-1 (Server)
FS Elevation Angle (deg)	Io/No (dB)	Io/No (dB)	Io/No (dB)
0	-44.9	-40.2	-42.7
5	-42.1	-37.4	-39.9
10	-38.4	-33.6	-36.1
15	-32.5	-27.8	-30.3
20	-18.9	-14.2	-16.7

M-STAR TRANSMITTER PARAMETERS (Cell Site)

Power Radiated	W	0.02
Output losses	dB	1.50
Carrier frequency	GHz	40
Information rate	Mbps	10.24
Pwr spectral density	dBW/Hz	-88.59
Antenna boresite gain	dBi	40.60
Off boresite angle	deg	0
Off boresite gain	dBi	40.60
EIRP (boresite)	dBW	22.11
EIRPSD (off boresite)	dBW/Hz	-47.99

CHANNEL PARAMETERS

Distance	km	2585.9
Total absorption	dB	1.80
Spreading loss	dB	192.74

FS RECEIVER PARAMETERS

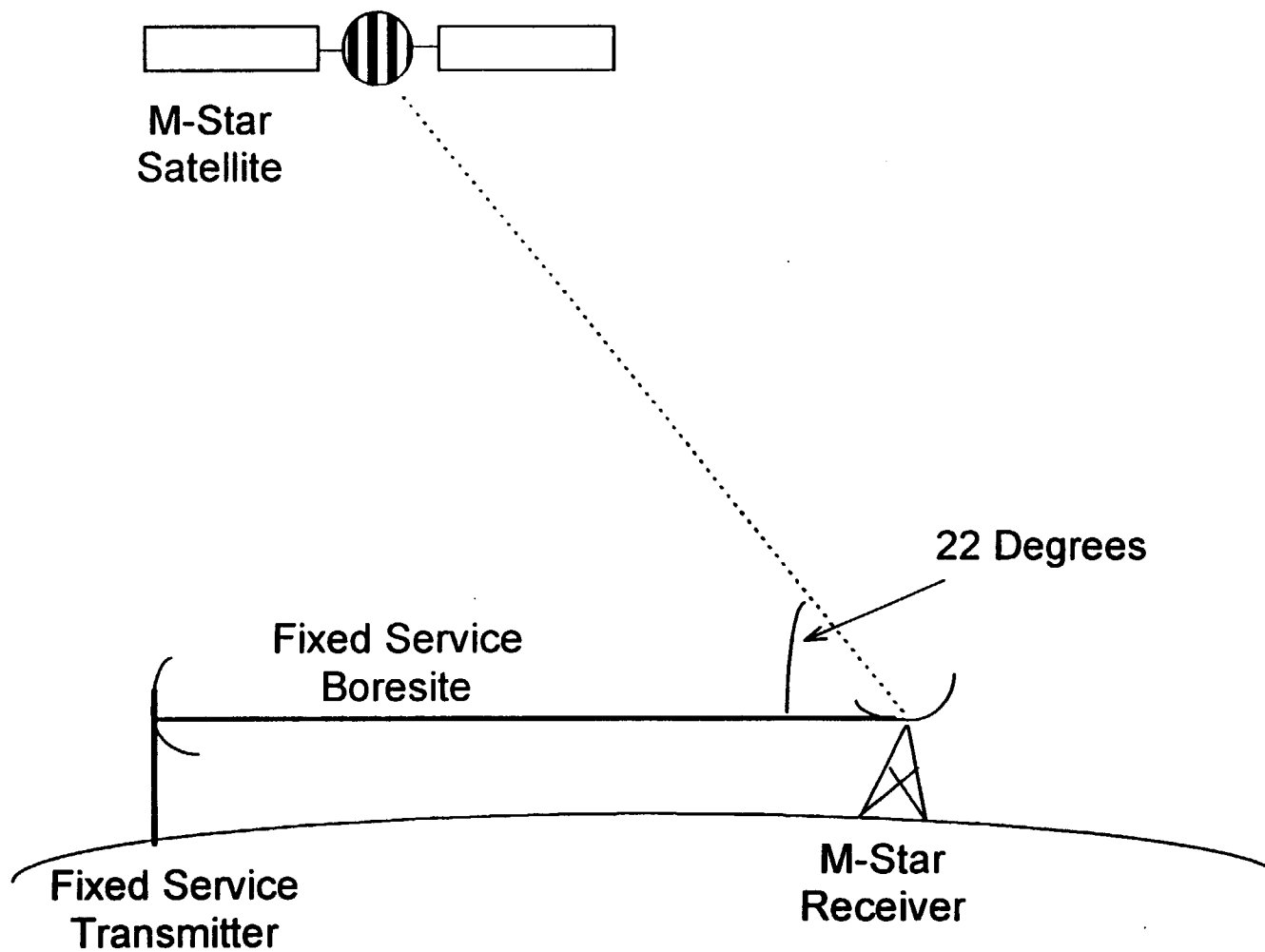
System temperature	K	1000
No	dBW/Hz	-198.60
Off boresite angle	degrees	2
Antenna diameter	m	0.66
Antenna boresite gain	dBi	46.60
Off boresight gain	dBi	25.03
Io	dBW/Hz	-217.50
Io/No	dB	-18.90



MOTOROLA

Satellite Communications Division

**Geometry of Fixed Service
into M-Star Downlink at 40 GHz**





MOTOROLA

Satellite Communications Division

FS into M-Star Earth Stations (37.5 - 40.5 GHz)

- **M-Star will accept interference from the Fixed Service located 1 km away at the level of $I_o/N_o = -13$ dB.**
- **Sharing Rules:**

EIRP Limits:

For Fixed Service transmitters with clear air EIRP density less than -28.4 dBW/MHz no coordination required. Fixed Service can exceed this limit by means of adaptive power control only to the extent where link propagation attenuation exceeds the clear air value due to precipitation.

Higher power terminals need to be coordinated.

**MOTOROLA****Satellite Communications Division****Analysis Details of Fixed
Service into M-Star Downlink
at 40 GHz****FS RECEIVER**

Receiver Noise Temp	deg	1000		
No	dBW/Hz		-198.60	
Reqd Co/No	dB		8.00	
Margin	dB		6.00	
Rx antenna gain	dBi		46.59	
Max tx EIRP	W	0.05	dbW	-13.01
Channel NBW	MHz	5		
	MHz	20		

BizTel Inc.**(File No.: 4228-CF-P/L-24)**5 MHz
Channel20 MHz
Channel**FS CHANNEL**

Frequency	GHz	40		
Tx-Rx distance	km	7.36		7.36
Spreading loss	dB		141.82	141.82
Atmos. Absorption	dB/km	0.13	0.96	0.96
Total propagation loss	dB		142.77	142.77

FS TRANSMITTER

Reqd EIRP dens	dBW/Hz		-88.42	-88.42
Reqd EIRP	dBW/channel		-21.43	-15.41
Tx antenna gain	dBi		46.59	46.59
Reqd Power dens	dBW/Hz		-135.01	-135.01

5 MHz 20 MHz
Channel Channel**FSS CHANNEL**

Tx-Rx distance	km	1		
Spreading loss	dB		124.48	124.48
Atmos. Absorption	dB/km	0.13	0.13	0.13
Total path loss	dB		124.61	124.61

FSS RECEIVER

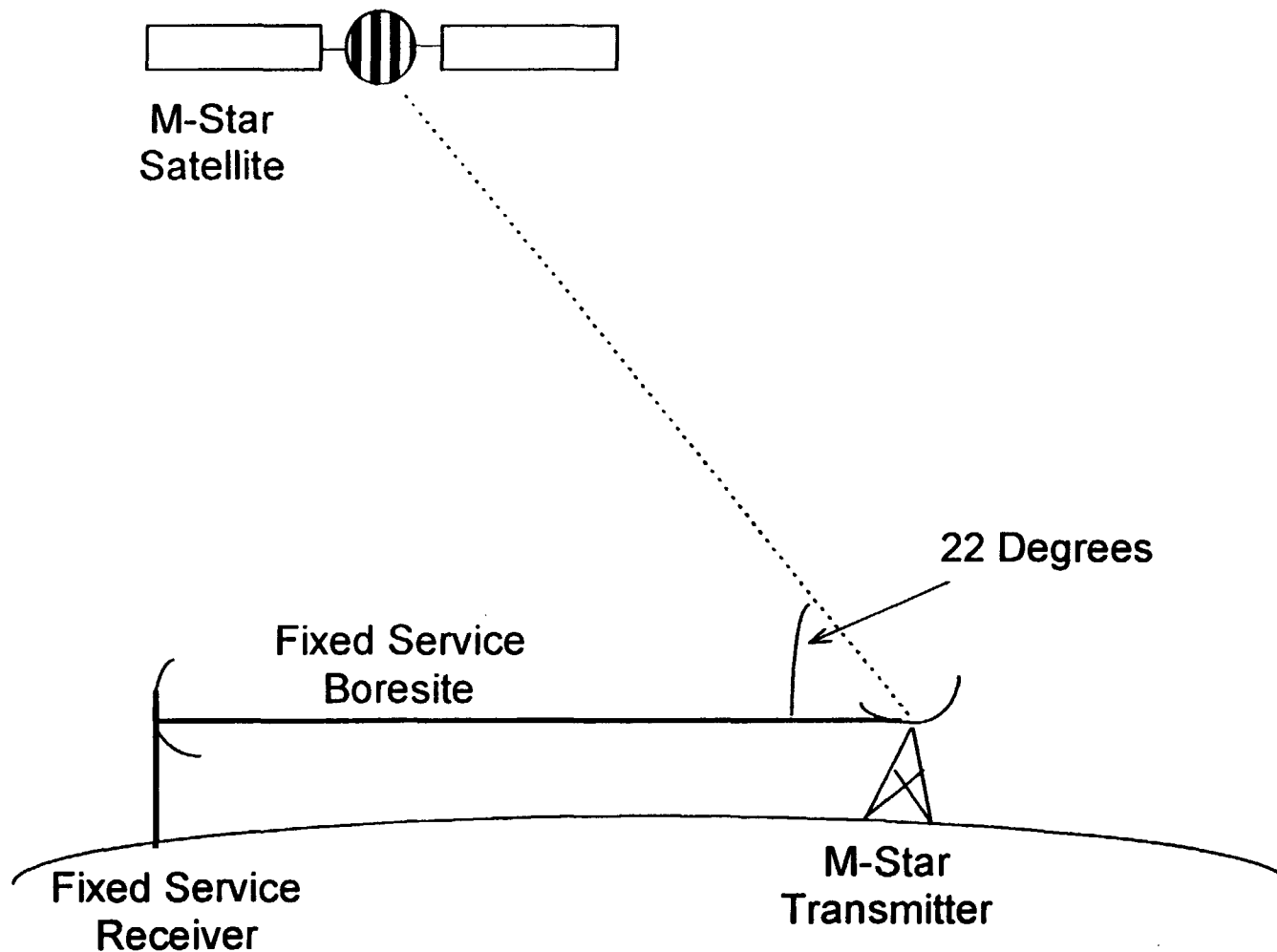
Rec. Noise Temp.	K	503		
No	dBW/Hz		-201.58	-201.58
Rx antenna gain	dBi		-1.56	-1.56
Io	dBW/Hz		-214.59	-214.59
Io/No	dB		-13.01	-13.01



MOTOROLA

Satellite Communications Division

Geometry of M-Star Earth Station
into Fixed Service at 50 GHz





MOTOROLA

Satellite Communications Division

M-Star Earth Stations into FS (47.2 - 50.2 GHz)

- **M-Star is below EIRP limits of 47 CFR 25.204(b)**
- **Maximum required separation distance for Io/ No to be below -13 dB (5% rise in noise floor) is 69.2 km for Fixed Service main beam interactions.**
- **Coordination with Fixed Service will be required.**

**MOTOROLA****Satellite Communications Division****Analysis Details of M-Star
Uplink into Fixed Service
at 50 GHz****SEPARATION DISTANCE OF M-STAR UPLINK TO ACHIEVE $I_o/N_o = -13$ dB**

	Cell Site	OC-1 (MTSO)	OC-1 (Server)
FS Azimuth Angle (deg)	Distance (km)	Distance (km)	Distance (km)
0	67.0	59.5	69.2
2.5	23.0	18.1	24.5
5	14.4	10.7	15.5
10	8.1	5.7	8.9
45	1.7	1.1	1.9

M-STAR TRANSMITTER PARAMETERS (Cell Site)

Power Radiated	W	1.5
Output losses	dB	0.50
Carrier frequency	GHz	50
Information rate	Mbps	10.24
Pwr spectral density	dBW/Hz	-68.84
Antenna boresite gain	dBi	49.30
Off boresite angle	deg	22
Off boresite gain	dBi	-1.56
EIRP (boresite)	dBW	50.56
EIRPSD (off boresite)	dBW/Hz	-70.40

CHANNEL PARAMETERS

Distance	km	67.00
Total absorption (0.4 dB/km)	dB	26.80
Spreading loss	dB	162.94

FS RECEIVER PARAMETERS

System temperature	K	1000
No	dBW/Hz	-198.60
Off boresite angle	degrees	0
Antenna diameter	m	0.66
Antenna boresite gain	dBi	48.53
Off boresight gain	dBi	48.53
I_o	dBW/Hz	-211.61
I_o/N_o	dB	-13.01



MOTOROLA

Satellite Communications Division

**Geometry of Fixed Service into
M-Star Uplink at 50 GHz**

